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| Time from production | Microfiltered + paszteurized milk | | | Pasteurized milk (control) | | |
|---|---|---|---|---|---|---|
| | Mesophilic micro-organisms | Thermophilic microorganisms | Mesophilic bacterial spores | Mesophilic micro-organisms | Thermophilic microorganisms | Mesophilic bacterial spores |
| cfu/g | | | | | | |
| Day 6 | 20 | <10 | <10 | 120 | <10 | 10 |
| Day 17 | <10 | <10 | 10 | 410 | <10 | 30 |
| Day 24 | <10 | <10 | <10 | 2 000 | <10 | 30 |
| Day 31 | <10 | <10 | <10 | 53 000 | <10 | 30 |
| Day 41 | 30 | <10 | <10 | not examined | | |
| Day 51 | <100 | <10 | <10 | | | |
| Day 61 | 2500 | <10 | 80 | | | |

Based on the organoleptic examinations, characteristics of the microfiltered milk evaluated on day 60 were impeccable. However, in case of the control pasteurized milk, its organoleptic quality was gradually worsening from day 31. The reason was the multiplication of mesophilic bacteria, starting around day 24.
By the combined use of microfiltration and pasteurization shelf life can be substantially extended also in case of camel milk. The chosen low filtration temperature does not damage the heat-sensitive milk components and its important advantage is that the process besides live bacteria cells also removes from milk the dead bacteria with their enzymes. Length of the so achievable shelf life depends on the microbiological characteristics of the initial milk, the processing hygiene and the applied technology.

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## TRACE ELEMENTS AND HEAVY METALS IN ORGANS OF CAMELS (*CAMELUS DROMEDARIUS*) SLAUGHTERED IN CASABLANCA CITY, MOROCCO

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**Abstract**

The present work was carried out to determine the concentrations of trace elements (copper and zinc) and heavy metals (cadmium and lead) in the different organs of camel slaughtered in municipal slaughterhouse of Casablanca, which is the main source of consumption of camel meat in the study area. The samples of meat, liver, lung, heart and kidney of 30 camels were collected. All the samples were digested, mineralized and analyzed for minerals using an Inductively Coupled Plasma - Atomic Emission Spectroscopy. The concentrations of trace elements and heavy metals ranged from 1.10 to 14.22 ppm for copper, 4.05 to 10.88 ppm for zinc, 0.023 to 0.69 ppm for cadmium and 0.71 to 1.33 ppm for lead. Few data are available in literature on copper and zinc concentrations in different organs of camel. The highest concentration of copper was observed in liver. For zinc the highest concentrations being recorded in meat and liver. Regarding cadmium and lead concentrations in different organs of camel, it is difficult to link our results to polluting context, because no data on these elements in camel organs available. However, the concentrations of cadmium in kidney and liver were higher than that observed in other organs. For lead, the highest concentration was observed in liver.

*Key words: trace elements, heavy metals, organs, camel, consumption*

## ЭЛЕМЕНТТЕР МЕН АУЫР МЕТАЛДАРДЫҢ КАСАБЛАНКА ҚАЛАСЫНДАҒЫ ТҮЙЕ *(CAMELUS DROMEDARIUS)* МҮШЕЛЕРІНДЕГІ МӨЛШЕРІН ҚАДАҒАЛАУ, МОРОККО

Бұл жұмыс зерттелетін өңірдің негізгі ет көзі болып табылатын Касабланка қаласының муниципалды қасапханасында сойылған түйе мүшелерінің құрамындағы элементтер (мыс және цинк) және ауыр металдар (кадмий және қорғасын) мөлшерін қадағалау үшін жасалды. Ол үшін 30 түйенің ет, бауыр, өкпе, жүрек және бүйрек сынамалары алынды. Барлық сынамалар қорытылып, минерализденіп, Индуктивті Плазма Жалғасқан – Атомды Эмиссионды Спектроскопия (ICP-AES) арқылы зерттелді. Элементтер мен ауыр металдардың қалдық мөлшері мыс үшін 1.10 14.22 ппм, цинк үшін 4.05 до 10.88 ппм, кадмий үшін 0.023 до 0.69 ппм және қорғасын үшін 0.71 1.33 ппм аралығында болды. Әдебиетте түйе мүшелеріндегі мыс пен цинк болуы туралы мәліметтер аз. Қорғасынның ең жоғары концентрациясы бауырда табылды. Цинк үшін ең жоғарғы концентрация ет пен бауыр құрамында табылды.

Кадмий мен қорғасын концентрацияларына келетін болсақ, ластағыш контекстке қарағанда бұл мәліметтерді өзара салыстыру қиынға соқты, ол бұл элементтердің түйе мүшелерінде болу туралы мәліметтің аздығынан болды. Оған қарамастан, кадмий концентрациясы басқа мүшелерге қарағанда бүйрек пен бауыр құрамында ең жоғары шамаларды көрсетті. Қорғасын үшін ең жоғары концентрация бауырда табылды.

*Түйін сөздер: Элементтердің қалдық концентрациясы, Ауыр металдар, Мүшелер, Түйе, Тұтыну.*

## МИКРЭЛЕМЕНТЫ И ТЯЖЕЛЫЕ МЕТАЛЛЫ В ОРГАНАХ ВЕРБЛЮДОВ *(CAMELUS DROMEDARIUS)* ЗАБИТЫХ В ГОРОДЕ КАСАБЛАНКА, МАРОККО

Данная работа была выполнена с целью определения концентрации элементов (меди и цинка) и тяжелых металлов (кадмий и свинец) в разных органах верблюдов, забитых на муниципальной скотобойне Касабланки, которая является основным источником потребляемого мяса в изучаемом регионе. Были отобраны пробы мяса, печени, легкого, сердца и почек 30 верблюдов. Все пробы были переварены, минерализованы и проанализированы с помощью Инвуктивно Связанной Плазмы – Атомно-Эмиссионной Спектроскопии (ICP-AES). Концентрации остаточных количеств элементов и тяжелых металлов были в диапазоне от 1.10 до 14.22 ппм для меди, от 4.05 до 10.88 ппм для цинка, от 0.023 до 0.69 ппм для кадмия и от 0.71 до 1.33 ппм для свинца. В литературе мало данных о содержании меди и цинка в разных органах верблюда. Наиболее высокая концентрация свинца была обнаружена в печени. Самая высокая концентрация цинка была обнаружена в мясе и печени. Что касается концентраций кадмия и свинца, было сложно связать наши результаты с загрязняющим контекстом, так как не имеется данных о содержании этих элементов в органах верблюда. Несмотря на это, концентрации кадмия в почках и печени была выше, чем в других органах.

*Ключевые слова: Остаточное количество элементов, тяжелые металлы, Органы, Верблюд, Потребление.*

### Introduction

Camel is a source of high quality animal protein especially in arid and semi-arid areas which adversely affect the performance of other meat animals (Faye et al., 2013). Camel meat contains some trace elements, such us copper (Cu) and zinc (Zn), that are useful for the metabolism and biological processes of the human consumers (Faye and Bengoumi, 1998). However, they may also accumulate heavy metals, such as cadmium (Cd) and lead (Pb), which do not play any known metabolic role and may be a potential health hazard to human as consumer and camel (Konuspayeva et al., 2011). To our knowledge, no analytical work has been undertaken so far on trace elements and heavy metals contents in camel organs in Morocco. The aim of the present study was to investigate the distribution of copper, zinc, cadmium and lead in meat, liver, lung, heart and kidney of camels in municipal slaughterhouse of Casablanca which is the main source of camel meat in the study area.

### Materials and methods

Samples collection: Samples of meat, liver, lung, heart and kidney were collected from thirty healthy camels 4-5 years old weighing 300-350 kg. For each animal, samples were collected accompanied by a veterinary hygiene inspector who helped in the organs' collection.

Samples analysis: For each collected sample a quantity of 0.2 to 0.7 g is digested with sulfuric acid in eppendorf tubes, and mineralized by using a plate of mineralization in two steps, with nitric acid first, then by hydrogen peroxide in the second step (Hill et al., 1986). Trace elements and heavy metals analyses were conducted at the Technological and Scientific Research Support Units (UATRS) of the National Center for Scientific and Technical Research (CNRST) at Rabat, Morocco. The mineral contents were determined using Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES). Standard solutions used are of commercial type containing the mineral analyzed in a pure state. Each analysis was repeated in triplet.

Statistical analysis: Statistical differences between mineral contents of the organs (meat, liver, lung, heart and kidney) were determined by one-way analysis of variance (ANOVA). Pearson correlation analysis was conducted for the organs Cu, Zn, Cd and Pb contents.

### Results and discussions

Trace elements status and reference values are relatively scarce and few data regarding their contents in camel organs are available in the literature. However, data on heavy metals are not available in camel organs, but there are some studies which were realized on heavy metals in camel blood and milk. On the other hand, the data on heavy metals were widely described in other species as cattle and sheep.

The results are summarized in Table 1.

The low contents observed in other organs than liver attested the predominant role of this organ in copper and zinc storage. In camel liver, copper contents varied according to the copper status of the diet and could change with the type of food supplementation, but no change in zinc contents was observed in spite of zinc supplementation in the diet (Bengoumi et al., 1998). The lower contents observed in our study may be attributed to copper and zinc deficiency in the diet consumed by camel. The significant difference between organs in term of minerals accumulation could be attributed to specific physiological functions of the organs.

Table 1. Trace elements and heavy metals contents in camel organs (Mean±SD).

| | Cu (ppm) | Zn (ppm) | Cd (ppm) | Pb (ppm) |
|---|---|---|---|---|
| Meat | 1.10±0.24 $^{a}$ | 9.84±0.36 $^{b}$ | 0.12±0.03 $^{c}$ | 0.71±0.06$^{a}$ |
| Liver | 14.22±6.12$^{c}$ | 10.88±1.73 $^{b}$ | 0.25±0.03 $^{c}$ | 1.33±0.29$^{c}$ |
| Lung | 1.65±0.49 $^{a,b}$ | 4.05±0.15 $^{a}$ | 0.023±0.002$^{a}$ | 0.86±0.17$^{a,b}$ |
| Heart | 2.06±0.22$^{b}$ | 4.85±0.41 $^{a}$ | 0.089±0.02 $^{b}$ | 1.04±0.31 $^{b}$ |
| Kidney | 1.43±0.14$^{a}$ | 4.71±0.50 $^{a}$ | 0.69±0.13 $^{d}$ | 0.96±0.17$^{b}$ |

[a,b,c,d]values with different subscript differ at p<0.05, SD: Standard Deviation.

In our study, it was difficult to attest if cadmium and lead contaminations of camel organs were important or not, as to our knowledge, no reference was available for this species in the literature. However, cadmium and lead contents found in camel organs appeared widely higher than the tolerable values for meat and offal of bovine as proposed by the European Commission (European Commission, 2006), with the exception of cadmium contents found in liver and kidney that were lower than the limit of European Commission in bovine liver and kidney (European Commission, 2006). The sources of cadmium and lead may be attributed to the pasture on which these animals grazed and the source of water from which these animals drank.

Relationships between elements contents are not well explained, especially when those relationships could change from one organ to another. Few data are available on the distribution of trace elements among organs, especially in camel. The interactions are complex, including competition on site-binding, potentiation, target-organ preference, storage and excretion priorities.

**Conclusion**

The study showed that the liver play an important role for storing trace elements. High level of heavy metals (cadmium and lead) contents were observed in meat, lung, heart and kidney. Livers content of these heavy metals are lower than the maximum limit fixed by the European Commission? Further studies are still needed it better understand the metabolism of trace elements and heavy metals in camels.

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## BACTRIAN CAMELS' ASSESSMENT ON MILK PRODUCTION ON THE SHUBAT FARM

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**Abstract**

For the formation of high-dairy ewes breeding group, creating valuable nests and families, as well as the feasibility study (FS) of shubat farms is very urgent problem of developing a method for evaluating camels for milk production.

We propose a method of estimating the two-humped camels for milk production, which allows them to select not only the largest milk yield, but also on the content of fat in milk and provides a reliable assessment of milk production camels.

This method of estimating the two-humped camels for milk yield, average daily milk yield includes the definition and the actual milk fat by means of conversion factors, calculations corrected milk yield and its meaning 4% fat Bactrian camel's evaluation using a single scale milk production per day for 2-3 months of lactation.

Fundamental systemic conceptual approach is a new way of identifying the level of daily milk production of animals; characterize their ability to use standard indicators of the cost of feed (feed. unit) in the grazing period. The ability to use each camel fodder during this period to some extent reflected the best value for a productive and supportive feed. In addition, such relationship cannot be determined for only one value of the average daily milk production, provided the well-known traditional scale, without taking into account the differentiated as milk fat, and the value of live weight of two-humped (Bactrian) and single-humped (Dromedary) camels.

## ШҰБАТ ФЕРМАЛАРЫНДА ҚОС ӨРКЕШТІ ІНГЕНДЕРДІ СҮТ ӨНІМДІЛІГІ БОЙЫНША БАҒАЛАУ

Сүт өнімділігі жоғары асыл тұқымды саулықтар тобын құру, бағалы ұяларды және отбастарды қалыптастыру, сондай-ақ шұбат шаруашылықтары үшін техникалық-экономикалық негіздемесін (ТЭН) құрастыру үшін сүт өнімділігі бойынша түйелерді бағалау әдісін әзірлеу өте өзекті мәселе болып табылады.

Түйелерден сүт өндірудің сенімді бағалауды қамтамасыз ететін, тек сауу мөлшері бойынша ғана емес, сонымен қатар сүт майлылығы бойынша түйелердің сүт өнімділігінің бағалау әдісін ұсынамыз.

Осы әдіс арқылы қос өркешті түйе сүтінің өнімділігін, ауыспалы коэффициенттің көмегімен орташа тәуіліктік сауылуынын және сүттің нақты майлылығын бағалау, өңделген сауындыны 4 % майлылығы қос өркешті түйе сүтінің нормативті шкала бойынша өнімділігі тәуілігіне 2-3 ай мерзімі болып саналады.

Концептуальды жүйенің болжамдық негізіне қарай жаңа тәсіл тәуіліктік сүттің құндылығының деңгейін анықтап олардың жайылымының мерзімін және азықтану шығынының орташа көрсеткішін сипаттайды.